



## Diurnal Variation of Serum Iron Level among Apparently Healthy Sudanese Adults

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### Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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### ABSTRACT

**Background:** Assessment of iron status in clinical studies is often based on a single blood sample, Thus if diurnal variations in serum iron levels is large (morning samples were assumed to be higher than afternoon or evening levels). This may lead to the individual iron status may be misinterpreted especially in case of regular follow up of patients under iron therapy.

**Objectives:** The purpose of the present study was to study the diurnal variation in serum iron levels among apparently healthy adult Sudanese volunteers.

**Materials and Methods:** A total of 70 apparently healthy individuals were recruited to participate in this study during the period from March to May 2013 in Khartoum state, their age ranged from 17 to 35 years, out of them, 31 (44.5%) were males and rest 39 (55.5%) females. Three ml of venous blood sample was collected from each participant into lithium heparin anticoagulant containers two times at 8:00 AM and at 5:00PM. The serum iron level was determined using COBAS INTEGRA system (chemistry analyzer).

**Results:** The result showed that there was no significant difference in mean serum iron level between morning and evening samples in males ( $p$  value  $>0.05$ ) whereas it was significant in females ( $p < 0.05$ ).

**Conclusion:** There was an obvious difference between morning and evening concentration of serum iron and there was significantly different in means according to gender.

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## 1. INTRODUCTION

Iron is a mineral that is naturally present in many foods, added to some food products, and available as a dietary supplement. Iron is an essential component of hemoglobin, an erythrocyte protein that transfers oxygen from the lungs to the tissues [1]. As a component of myoglobin, a protein that provides oxygen to muscles, iron supports metabolism [2]. Iron is also necessary for growth, development, normal cellular functioning, and synthesis of some hormones and connective tissue [2,3].

It is an essential nutrient, but one with considerable potential for toxicity. It is therefore understandable that the uptake and disposition of iron are controlled by elaborate physiological mechanisms. Although the highly regulated nature of iron metabolism has been recognized for decades, the mechanisms governing its regulation have only recently been elucidated. This has been made possible by the discovery of a variety of proteins involved in iron transport, as well as the iron-regulatory hormone, hepcidin [4].

Serum iron is an important parameter for diagnosis, follow up of patients suffering from iron deficiency anaemia as well as for the transfusion dependent patients and according to the books restriction the sample for serum iron estimation must be collected at morning while in practice this restriction doesn't followed. The prevailing opinion is that iron levels are higher in the morning than in the afternoon or evening. [5,6]. So our study was interested to see whether books restriction regarding collection of samples for serum iron at morning is mandatory for serum iron samples collection or not.

Serum iron test and other parameters of iron profile studies is widely done in the laboratories in the purpose of screening and monitoring for patients with iron deficiency anaemia and iron over load.

The study was aimed to study the diurnal variation of serum iron level among normal Sudanese subjects and to study whether our practice regarding restricting collection of serum samples to the morning is necessary.

## 2. MATERIALS AND METHODS

Seventy apparently healthy Sudanese volunteers from Al Neelain University were recruited to

participate in this cross-sectional study in the period from March to May 2013. A 3 mL lithium heparin evacuated tube was used to collect blood at 8:00 AM, and at 5:00 PM. 8:00 AM specimens were obtained after an overnight fast, and all subjects were fasting for at least 2 hours before collection of the 4:00 PM specimens. Plasma was separated from each sample after centrifugation and then stored at 4°C until analyses. Iron levels were determined by FerroZine-iron complex spectrophotometry on a COBAS INTEGRA 700 analyzer (Roche Diagnostics, Germany). This study was approved by the ethical committee of the faculty of medical laboratory sciences, Al Neelain University, Khartoum-Sudan.

### 2.1 Statistical Analysis

Continuous data were presented in mean  $\pm$  standard deviation while categorical data in frequency and percentage. Paired sample t test was used to calculate the significance level of mean difference between pre-post observations. A p value  $< 0.05$  have been considered as statistically significant. Statistical package for social sciences, version 16 (SPSS-16) was used to analyzed of the data.

## 3. RESULTS

This study was conducted to evaluate the diurnal variation of serum iron levels among apparently healthy Sudanese individuals recruited from Alneelain University in the period from March to May 2013. Out of 70 volunteers, those were enrolled in this study, 31(44.3%) of them were males and 39 (55.7%) of them were females. The age of those volunteers ranged between (17-35) years.

The mean of serum iron level for morning samples (collected at 8:00 AM) and for evening-afternoon samples (collected at 5:00 PM) among males was  $15.4 \pm 5.3$  and  $15.7 \pm 6$  respectively. Paired t test revealed that there was no significant difference in mean value of serum iron level of male volunteers between morning and evening samples (p value  $> 0.05$ ). Whereas the mean of serum iron level for morning samples (collected at 8:00 Am) and for evening afternoon samples (collected at 5:00 P.M) among females was  $10.3 \pm 5.4$  and  $12.9 \pm 4.7$  respectively and mean difference in serum iron level between two was statistically significant (p value  $< 0.05$ ).

#### 4. DISCUSSION

This study was aimed to evaluate the diurnal variation of serum iron among healthy individuals. Including 70 volunteers 39 (55.7%) of them were females and 31 (44.3%) of them were males.

Our results showed that there was significant diurnal variation in morning and evening serum iron concentration results in females but was not significant in males and this finding agree with previous study of Jane C, et al. [7] who were examined 20 healthy adult volunteers at 8:00 AM, noon, and 4 PM (day 1) and 8:00 AM (day 2). They found that there was significant differences among mean values for the various collection times observed for serum iron (P. value = 0 .01).

Also our findings agree with study done by Rita Long, et al. [8] who's their results revealed that serum iron concentrations of 18 out of 25 subjects decreased from morning to afternoon. This decrease ranged from 4 to 61%, with an average of 21% and the mean iron concentration for the 25 subjects was 990 µg/liter in the morning and 870 µg/liter in the afternoon.

The findings of the percent study is disagree with We conclude that the practice of restricting iron specimen collections to a specific time of day does not improve the reliability of the test result.

#### 5. CONCLUSION

On the basis of our data we suggest that the collection of blood sample from individuals for the assessment of iron status must be restricted to the morning time because of the diurnal variation.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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